



END OF THE WORLD

Various Ways in Which Our Earth
May Cease to Exist

By CAMILLE FLAMMARION

WHERE in the universe is the earth bound for? Scientists know that our entire solar system is rushing along at the tremendous rate of seventy thousand kilometers (forty-three thousand miles) an hour toward a point in the heavens designated by the constellation Hercules. But whether this rate is greater or less in our day than in some prehistoric age, or even whether it has been so always, or will remain so, no man knoweth. And what shall we do when we get there? Ah! that is one of the riddles of the universe.

Another riddle more easily within range of human comprehension is the ultimate end of the earth—not where in the universe it is going to find rest, but what is to be the manner of its death. Will it fall into ruins, as an ancient monument of the firmament decayed by millions of centuries of existence? Yes, without doubt; for it is not immortal. It has not always existed, and will not always exist. The earth has had a birth, and will consequently die. But there are as many possible modes of death for a world, apparently, as for other living beings.

May Die of Old Age

PERHAPS the end most apparent to us all, that of sheer old age, may come to it. We see the water and air of our earth diminishing, and we see the plane of the continents gradually sinking, but certainly reducing the surface of the globe to one general level. This gives rise to the conjecture: Will the earth perish from drought and cold? or will it be overwhelmed by the conquering ocean?

Water sustains the heat and life of the earth. Should it disappear, this would mean the total extinction of all that lives, breathes, and renders nature active. Should the liquid element, on the contrary, invade the dry land, such an action, though diametrically opposed to the preceding, produces, nevertheless, a similar result. In either case it would mean the destruction of the human race. Both ocean and atmosphere have been in the past much more extended than now. There was even a time when all the great capitals of the world slept at the bottom of the sea, and we find even now in the midst of our continents undeniable traces of a former sojourn of the waters thereon.

Nothing is immutable here below. Everything is continuously in a state of transformation. The sun absorbs the ocean under the form of vapor, which is afterward condensed into clouds, and the latter produce the snow and rain that feed the springs, the brooks, the rivers, the streams, and these carry back to the sea the water the sun had previously absorbed from them in the form of vapor. Such is the order of circulation of the waters on our planet. This vast process, however, is not performed without causing loss or diminishing the volume of water, and consequently the extent of the ocean.

In order that the rain should return to the great common reservoir, the ocean, it necessarily must encounter impenetrable layers, along which it will

slide first as a bubbling spring, then as a limpid river, and finally as a raging stream; otherwise, it finds entry into the soil by all the fissures of the latter. A quantity of water apparently insignificant, but really important, on account of its action that is continued for centuries, is enabled by this latter means to penetrate the depths of the porous soil. Should it descend far enough to reach a sufficiently high temperature, it is transformed into vapor, such fact being most recently the cause of volcanic eruptions and of earthquakes. Generally it enters into chemical combination with the earth and rocks, forming hydrates. Such water is of course lost from the general circulation.

This deprivation of moisture seems to have been the fate already of some portions of our solar system. Our neighbor the moon, whose dimensions are inferior to those of the earth, cooled much more rapidly and passed much more quickly through the phases of planetary life. Its former seas, whereon the traces of the action of the waters are recognizable, are at present dried up, and no kind of evaporation, no cloud, is discernible thereon. On the planet Mars, which is also smaller than the earth, and certainly in a more advanced period of planetary life, without being so aged as the moon, we observe seas reduced to narrow inland straits; the great oceans have disappeared; rain is rare; and the sky is nearly always clear.

Doubtless the future reserves for us a destiny, first, similar to that of the present state of Mars, then, similar to that of our satellite, the moon.

While to every two hundred molecules of oxygen and of nitrogen there is found only one of water vapor, this latter possesses, nevertheless, eighty times more energy and efficacy than the other two hundred. These minute transparent drops suspended in the atmosphere act like heat condensers to concentrate the rays of the sun and to retain them in the lower layers of the atmosphere. What will happen when this protecting veil shall have disappeared? The temperature of the soil will become glacial and will render the globe uninhabitable. From the summit of the mountains the mantle of the snows will be spread over the valleys, driving before it both life and civilization. At the completion of this epoch our planet will have reached a temperature approximating two hundred and seventy-three degrees below zero.

End of the Sun

BUT will our globe live long enough to reach this distant age? and will it finally sleep in this mortal cold? Could not terrestrial life suffer a different and a more rapid death? Would it not be possible for the ocean to recover its supremacy over the continents, and to spread anew, as at the dawn of terrestrial life, its liquid mantle over each part of the earth?

Everywhere about us we observe the leveling processes of nature in widely variant forms, and to this leveling process man lends willing hands. It is easy to comprehend the completion of the process, and thus there are two different modes of death, two diametrically opposed ends, the one resulting from the disappearance of the water, the other from its invasion, the processes being carried on henceforth with different degrees of intensity. Which of the two will conquer the other? This cannot yet be calculated.

The study of the universe shows us a third fate equally probable. Our sun is the potent governor of all that exists here, and even it is not invulnerable to the ravages of time; the day must come when it will lose heat, light, and will finally be extinguished. The heat radiation of our sun is indeed one of imaginary magnitude; and the amount of heat that the planets intercept on their passage through space is insignificant, representing hardly the two

hundred and twenty-seven-millionth part of the total radiation. The rest is lost in space.

We do not know how the sun maintains its formidable combustion; but it appears sufficiently accounted for from the fact of its continued, gradual condensation according to the best established principles of thermodynamics. If it condenses at present rapidly enough to compensate for so potent a radiation, this sun is not yet beginning to cool; but, whatever may happen, it will begin to do so one day. Darkness will gradually come on. A solid crust will become fixed in the place of the mobile surface of this fiery globe. Then the world must inevitably become, as all the other worlds of the solar system, a frozen cemetery, continuing doubtless to turn as a dark ball around another dark ball and to follow its movements in the eternal night, carried along with the other planetary tombs in the infinite abyss.

Fate Millions of Years Away

THIS fate seems millions of years distant; and long before reaching this period physical life, human force, nutrition, ideas, religions, sciences, languages, all will have been changed, and even the geography of our globe will be vastly different from that of to-day. Humanity, now in its childhood, as we perceive only too clearly from its puerility and inconsistency, has before it an immense future, as immense as the immensities of the universe. We may therefore hope that some day it will attain a certain social harmony, peace or concord, and will live according to the dictates of reason. That it will ever attain perfection is improbable, since the organic conditions of our little planet are themselves too imperfect. On our own planet, one must eat to live, and one must kill to eat, which state of things is contrary to perfect development. Even though at a future period it be possible to feed by means of chemical substances, there would always remain the great imperfection of our senses which cannot deceive us as to the exact reality.

Various accidental deaths are also within our comprehension. Our earth might dash against a long train of uranulites that would crush it either partially or completely. It might further be caught by a system of electric forces that would act like a brake upon its twelve movements, and that would either melt it or cause it to ignite. It might burst like the upper crust of a volcano, or be swallowed up in a titanic earthquake. It might lose the oxygen that enables us to live. It might be attracted by the passage of a celestial body that would thus bear it from the sun and would precipitate it into the icy depths of space, or it might possibly be literally roasted by a tenfold solar heat.

Then, too, there are comets. Have they not more than once caused alarm to humanity? Their number is considerable. Kepler has said that there exist as many comets in the heavens as fish in the ocean.

The sky is streaked with these wandering stars, flying round the sun like butterflies round

